6939

TWIN POWER PENTODE

Internally Neutralized for Push-Pull Amplifier Service | **9-Pin Miniature Type** | **14 Watts CW Input (ICAS) up to 500 Mc**

RCA-6939 is a twin power pentode of the 9-pin miniature type intended for use as a push-pull rf-power-amplifier tube or as a frequency-multiplier tube in communications equipment operating at frequencies up to 500 Mc. At 500 Mc, the 6939 can deliver useful power output of 5 watts in Continuous Commercial Service (CCS) or 6 watts in Intermittent Commercial and Amateur Service (ICAS).

The 6939 uses frame-type control grids which contribute to its high power sensitivity. It also uses plate and grid-No.2 materials having high heat dissipation capabilities. This feature insures low plate and grid-No.2 emission and low gas evolution, and thus contributes to stable operation of the 6939 for long periods. In addition, the use of a single cathode and grid No.2, common to both units, minimizes the effects of internal-lead reactance in push-pull circuit applications.

Built-in capacitors, connected from each plate to the control grid of the other unit, neutralize grid-to-plate feedback of each unit, and contribute to stable operation up to 500 Mc. Base pins and internal connectors made of material having high rf conductivity minimize rf losses.

GENERAL DATA

Electrical:

Heater, for Unipotential Cathode:			
Heater arrangement	*Series*	*Parallel*	
Voltage (AC or DC)	12.6 ± 10%	6.3 ± 10%	volts
Current	0.3	0.6	amp
Transconductance (each pentode) for dc plate volts = 150, dc grid-No.2 volts = 150 and dc plate ma. = 25	10500		μmhos
Mu-Factor, Grid No.2 to Grid No.1 (each pentode) for dc plate volts = 150, dc grid-No.2 volts = 150 and dc plate ma. = 25	31		
Direct Interelectrode Capacitances (Approx., without external shield):			
Grid No.1 to plate (each pentode)	0.15		μμf
Grid No.1 to cathode & grid No.3, grid No.2 and heater (each pentode)	6.4		μμf
Plate to cathode & grid No.3, grid No.2 and heater (each pentode)	1.6		μμf

Mechanical:

Operating Position	Any
Maximum Overall Length	2-5/8"
Maximum Seated Length	2-3/8"
Length, Base Seat to Bulb Top (Excluding tip)	2" ± 3/32"
Diameter:	
Maximum	0.875"
Minimum	0.750"
Bulb	T-6-1/2
Base	Small-Button Noval 9-Pin (JEDEC No.E9-1)

PUSH-PULL RF POWER AMPLIFIER & OSCILLATOR — Class C Telegraphy▲
and
PUSH-PULL RF POWER AMPLIFIER — Class C FM Telephony

Values are on a per-tube basis, unless otherwise specified

Maximum Ratings, *Absolute-Maximum Values:*

For Operation At Frequencies Up to 500 Mc

	CCS●	*ICAS***	
DC PLATE VOLTAGE	250 max.	250 max.	volts
DC GRID-No.2 (SCREEN-GRID) VOLTAGE	200 max.	200 max.	volts
DC GRID-No.1 (CONTROL-GRID) VOLTAGE	-100 max.	-100 max.	volts
DC PLATE CURRENT	90 max.	100 max.	ma
DC GRID-No.1 CURRENT	6 max.	8 max.	ma
DC CATHODE CURRENT	100 max.	120 max.	ma
PLATE INPUT	12 max.	14 max.	watts
GRID-No.2 INPUT	3 max.	3.5 max.	watts
GRID-No.1 INPUT	0.2 max.	0.24 max.	watt
PLATE DISSIPATION	6 max.	7.5 max.	watts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode	100 max.	100 max.	volts
Heater positive with respect to cathode	100 max.	100 max.	volts
BULB TEMPERATURE (At hottest point)	225 max.	225 max.	°C

Typical Operation at 500 Mc:

DC Plate Voltage	180	200	volts
DC Grid-No.2 Voltage	180	200	volts
DC Grid-No.1 Voltage	-20	-20	volts
From grid resistor for each grid of	27000	27000	ohms
Peak-to-Peak RF Grid-No.1 Voltage	50	50	volts
DC Plate Current	55	60	ma
DC Grid-No.2 Current	12.5	14	ma
DC Grid-No.1 Current	1.5	1.5	ma
Driver Power Output (Approx.)	1.2	1.2	watts
Useful Power Output (Approx.)♦	5	6	watts

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ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

6939 10-60
Printed in U.S.A.

PLATE-MODULATED PUSH-PULL RF POWER AMPLIFIER — Class C Telephony

Carrier conditions per tube for use with a max. modulation factor of 1.0

Values are on a per-tube basis

Maximum Ratings, *Absolute-Maximum Values:*

For Operation At Frequencies Up to 500 Mc.

	CCS●	ICAS**	
DC PLATE VOLTAGE.	200 max.	200 max.	volts
DC GRID-No.2 (SCREEN-GRID) VOLTAGE	200 max.	200 max.	volts
DC GRID-No.1 (CONTROL-GRID) VOLTAGE	-100 max.	-100 max.	volts
DC PLATE CURRENT.	64 max.	80 max.	ma
DC GRID-No.1 CURRENT. . . .	6 max.	8 max.	ma
DC CATHODE CURRENT.	80 max.	96 max.	ma
PLATE INPUT	8 max.	10 max.	watts
GRID-No.2 INPUT	2 max.	2.3 max.	watts
GRID-No.1 INPUT	0.2 max.	0.24 max.	watt
PLATE DISSIPATION	4 max.	5 max.	watts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode. . .	100 max.	100 max.	volts
Heater positive with respect to cathode. . .	100 max.	100 max.	volts
BULB TEMPERATURE (At hottest point). . . .	225 max.	225 max.	°C

Typical Operation at 500 Mc:

DC Plate Voltage.	180	180	volts
DC Grid-No.2 Voltage. . . .	180	180	volts
DC Grid-No.1 Voltage. . . .	-20	-20	volts
From grid resistor for each grid of.	68000	27000	ohms
Peak-to-Peak RF Grid-No.1 Voltage	45	50	volts
DC Plate Current.	40	55	ma
DC Grid-No.2 Current. . . .	9.5	12.5	ma
DC Grid-No.1 Current. . . .	0.6	1.5	ma
Driver Power Output (Approx.)	1	1.2	watts
Useful Power Output (Approx.)♦.	3.5	5	watts

FREQUENCY TRIPLER — Class C

Values are on a per-tube basis

Maximum Ratings, *Absolute-Maximum Values:*

For Operation At Frequencies Up to 500 Mc.

	CCS●	ICAS**	
DC PLATE VOLTAGE.	250 max.	250 max.	volts
DC GRID-No.2 (SCREEN-GRID) VOLTAGE	200 max.	200 max.	volts
DC GRID-No.1 (CONTROL-GRID) VOLTAGE	-100 max.	-100 max.	volts
DC PLATE CURRENT.	60 max.	80 max.	ma
DC GRID-No.1 CURRENT. . . .	6 max.	8 max.	ma
DC CATHODE CURRENT.	70 max.	80 max.	ma
PLATE INPUT	8 max.	10 max.	watts
GRID-No.2 INPUT	3 max.	3.5 max.	watts
GRID-No.1 INPUT	0.2 max.	0.24 max.	watt
PLATE DISSIPATION	6 max.	7.5 max.	watts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode. . .	100 max.	100 max.	volts
Heater positive with respect to cathode. . .	100 max.	100 max.	volts
BULB TEMPERATURE (At hottest point). . . .	225 max.	225 max.	°C

Typical Operation as Tripler to 500 Mc:

DC Plate Voltage.	180	200	volts
DC Grid-No.2 Voltage (Approx.)	180	190	volts
Through resistor of . . .	1200	1200	ohms
DC Grid-No.1 Voltage. . . .	-74	-74	volts
From grid resistor for each grid of.	82000	82000	ohms
Peak-to-Peak RF Grid-No.1 Voltage	165	165	volts
DC Plate Current.	40	46	ma
DC Grid-No.2 Current. . . .	9.7	11	ma
DC Grid-No.1 Current. . . .	1.8	1.8	ma
Driver Power Output (Approx.)	1.1	1.1	watts
Useful Power Output (Approx.)♦.	1.8	2.2	watts

▲ Key-down conditions per tube without amplitude modulation. Amplitude modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.

● Continuous Commercial Service.

** Intermittent Commercial and Amateur Service.

♦ This value of useful power is measured at load of output circuit.

OPERATING CONSIDERATIONS

The *maximum ratings* in the tabulated data are established in accordance with the following definition of the *Absolute-Maximum Rating System* for rating electron devices.

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron device of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.

The device manufacturer chooses these values to provide acceptable serviceability of the device, taking no responsibility for equipment variations, environment variations, and the effects of changes in operating conditions due to variations in device characteristics.

The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any device under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in device characteristics.

The *maximum bulb temperature* of 225° C is a tube rating and is to be observed in the same manner as other ratings. The temperature should be measured at the hottest point on the bulb with the tube operating in the completely assembled equipment with all covers in place, and delivering the maximum output under the highest ambient-temperature conditions and the most severe operating cycle for which the equipment is designed. The temperature may be measured with temperature-sensitive paint, such as

Tempilaq. The latter is made by the Tempil Corporation, 132 W. 22nd Street, New York 11, N.Y., in the form of liquid and stick.

Shielding of the 6939 in "straight-through" rf amplifier service may be required for stable operation. To minimize external feedback from the plate to grid No.1, a grounded shield crossing the terminal end of the tube socket through the space between pins 4 and 5 and the space between pins 1 and 9, is generally adeqate for this purpose.

The *heater may be effectively bypassed* by grounding one heater pin at the tube socket and bypassing the other heater pin to ground with a low inductance capacitor. If further isolation of the ungrounded heater pin is required a suitable rf choke followed by another low inductance bypass capacitor, is recommended.

The *cathode* of the 6939 should be grounded by means of the shortest possible connection to reduce the effect of cathode lead inductance.

The *rf impedance between grid No.2 and the cathode* must be kept low, usually by means of a suitable bypass capacitor. In telephony service when grid No.2 is modulated, a smaller bypass capacitor than is used for telegraphy service may be required in order to avoid excessive af bypassing. However, if the capacitance value is too small, rf feedback may occur between plate and grid No 1, depending on the circuit layout, operating frequency, and power gain of the stage. AF bypassing difficulties can usually be eliminated if the grid-No.2 bypass capacitor is replaced by a series-resonant circuit which is tuned to resonate at the operating frequency. This circuit presents a high impedance to audio frequencies but a very low impedance to its resonant frequency.

To *prevent generation of parasitic oscillations*, it is recommended that a 100-ohm resistor be connected in series with grid No.2 as close to the socket as possible.

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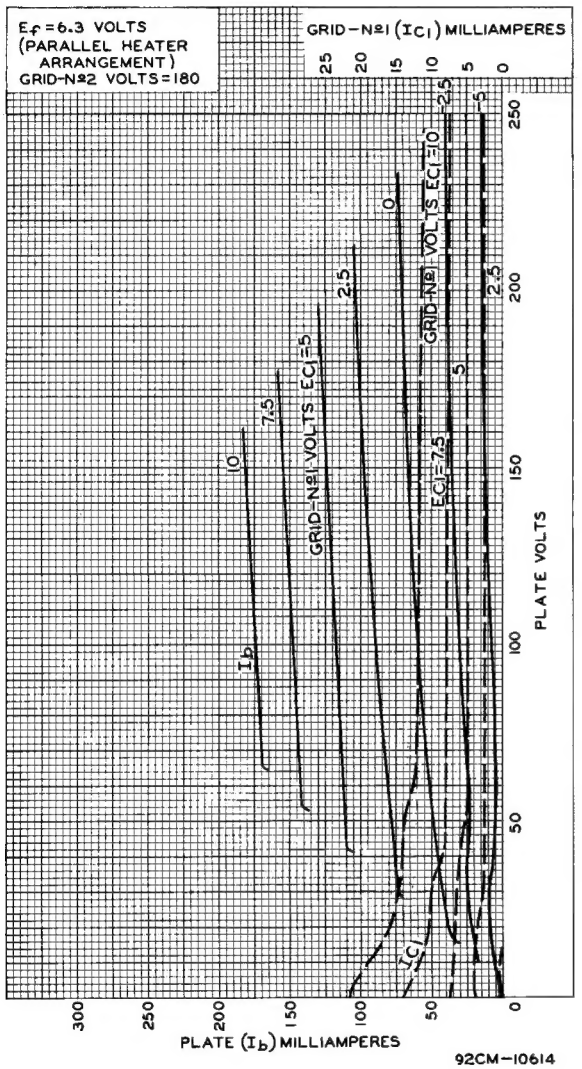


Fig. 1 - Average Characteristics for Each Pentode of Type 6939.

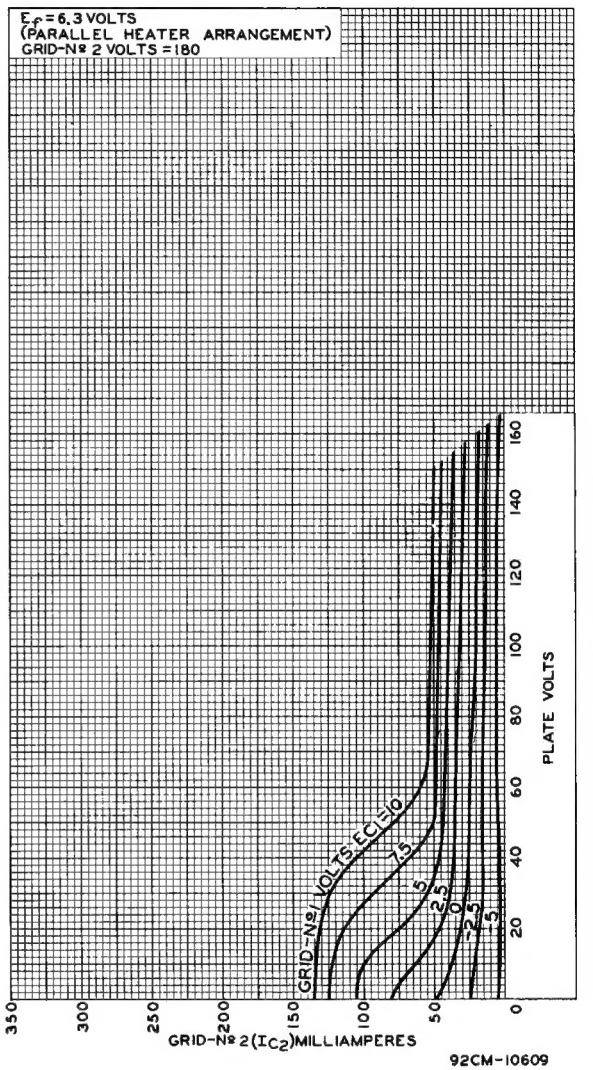


Fig. 2 - Average Grid-No. 2 Characteristics for Each Pentode of Type 6939.

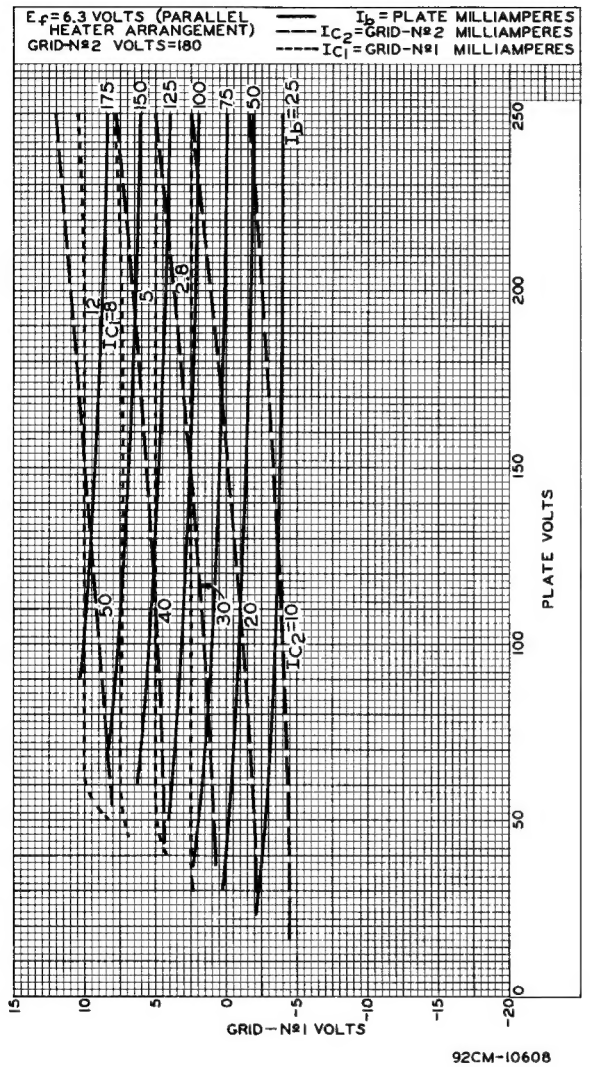


Fig. 3 - Average Constant-Current Characteristics for Each Pentode of Type 6939.

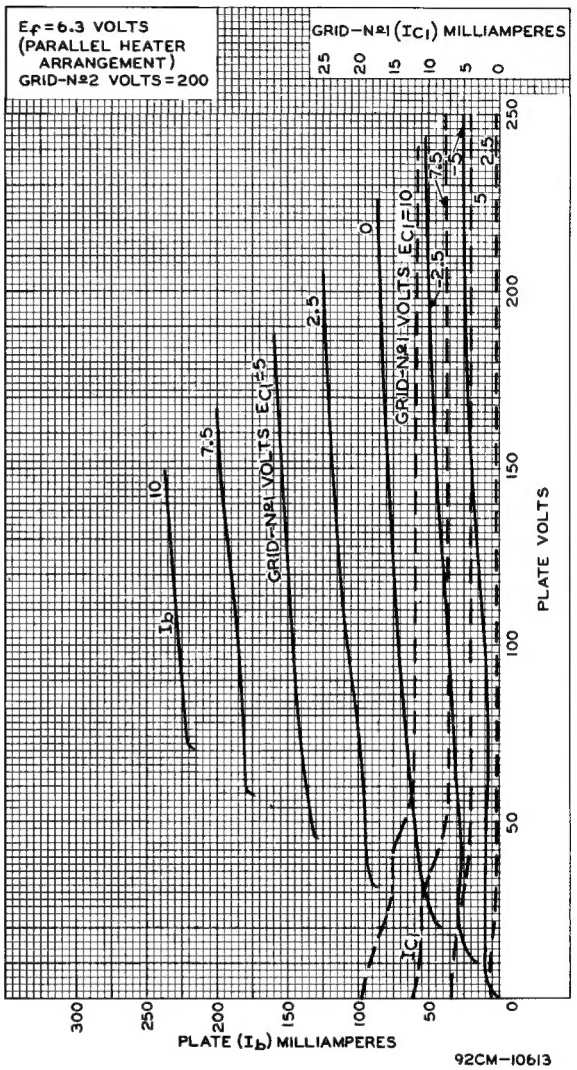


Fig. 4 - Average Characteristics for Each Pentode of Type 6939.

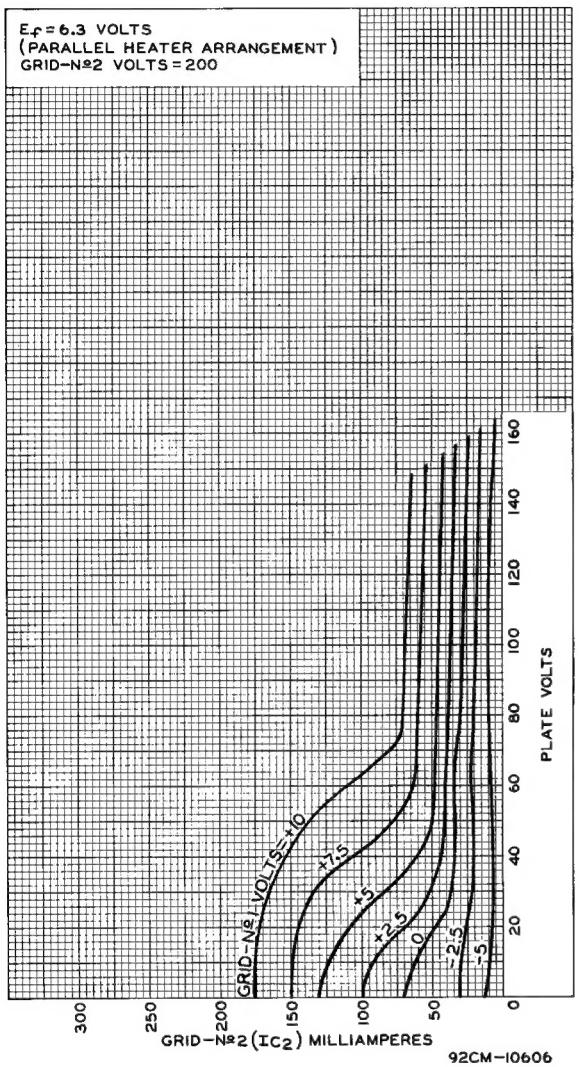


Fig. 5 – Average Grid-No. 2 Characteristics for Each Pentode of Type 6939.

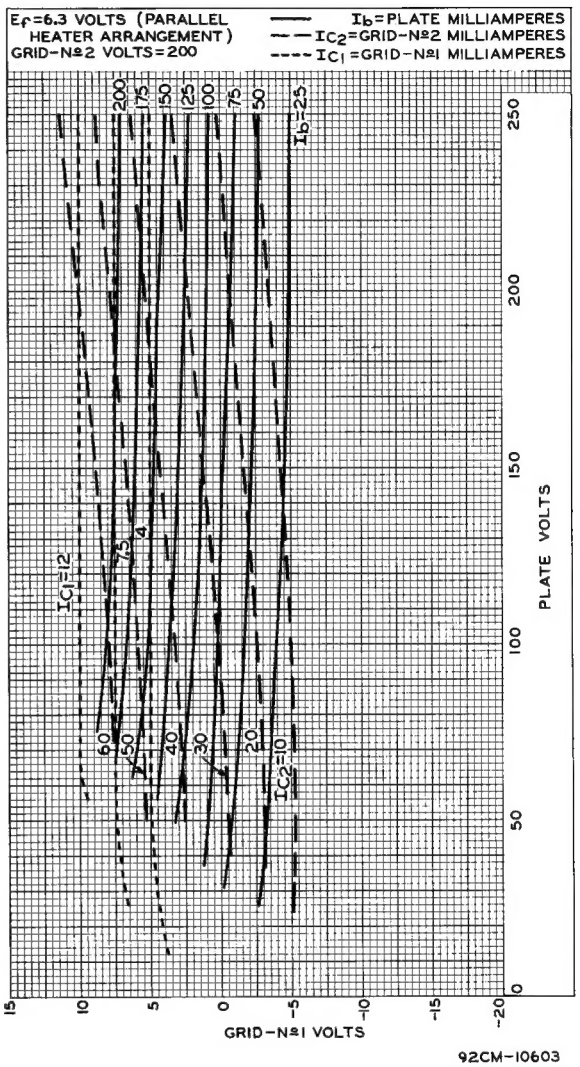
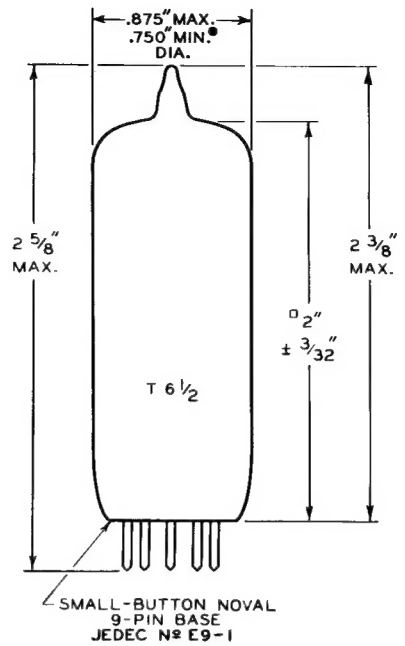


Fig. 6 – Average Constant-Current Characteristics for Each Pentode of Type 6939.

DIMENSIONAL OUTLINE



● APPLIES IN ZONE STARTING 0.375" FROM BASE SEAT.

□ MEASURED FROM BASE SEAT TO BULB-TOP LINE AS DETERMINED BY RING GAUGE OF 7/16" I.D.

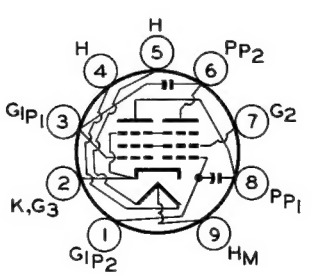
BASING DIAGRAM
Bottom View

PIN 1: GRID No.1 OF PENTODE No.2

PIN 2: CATHODE, GRID No.3

PIN 3: GRID No.1 OF PENTODE No.1

PIN 4: HEATER



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PIN 5: HEATER

PIN 6: PLATE OF PENTODE No.2

PIN 7: GRID No.2

PIN 8: PLATE OF PENTODE No.1

PIN 9: HEATER MID-TAP